

Swiss lakes, whereby prehistoric research was quickly extended and developed. Though many links are still missing, we may fairly consider the knowledge of the existence of primeval man as the beginning of the long-looked for connection between him and the anthropoids on the one hand, and between them both and their common progenitors on the other. In a word the time had come for the publication of the "Descent of Man"; that is why an opinion on the nature of man, which differs from all former ones fully as much as the system of Copernicus, of which it is the complement, differs from that of Ptolemy, found such ready and general acceptance.

How different was the fate of Copernicus! "Copernicus," says Poggendorff, "is, and will ever remain, a brilliant star in the firmament of science; but he rose at a time when the horizon was almost entirely obscured by the mists of ignorance. . . . The Ptolemaic system was too ancient and too much venerated to be easily displaced." Copernicus's teaching met with but scant appreciation for the first fifty years after its publication; even Tycho Brahe opposed it; it can therefore scarcely cause surprise that Luther rejected it, that Giordano Bruno died at the stake for his advocacy of it, while the less steadfast Galileo was forced to renounce it.

Notwithstanding the pessimism of our speculative philosophers, who deny all progress because they contribute nothing towards it, Darwin's lot was happier than that of the great reformer of astronomy. While Copernicus could only feast his eyes on the first printed copy of his work as he lay on his deathbed because he had not dared to publish it sooner, although he had completed it some years before, Darwin survived the appearance of his nearly a quarter of a century. He witnessed the fierce struggles its appearance at first gave rise to; its ever increasing acceptance and its final triumph, to which he, cheerful and active to the last, greatly contributed by a long series of admirable works.

While the Holy Inquisition persecuted the followers of Copernicus with fire and sword, Charles Darwin lies buried in Westminster Abbey among his peers, Newton and Faraday.

SINGING, SPEAKING, AND STAMMERING¹

III.—STAMMERING

AFTER the emotional and intellectual sides of human utterance, what may be termed its pathological aspect was considered. Imperfections of speech, though serious hindrances to intercourse, are unfortunately not uncommon. It is not easy to realise how common they are. The statistics collected by Colombat point to the conclusion that about two persons in every thousand stammer, an estimate which is exactly borne out by official returns obtained in Prussia. This would make two and a half millions of stammerers in the world. But it is hardly fair to argue from the higher to the lower races of mankind, for stammering, like hysteria, is undoubtedly a disease of advanced civilisation. It was unknown among the North American Indians in Catlin's time; Livingstone says he never met with a case among the Negroes, and Cameron is stated to have confirmed the observation. It is uncommon in Spain and Italy, but reaches its maximum in highly-educated Prussia and in this country. "No nation in the civilised world," says Mr. Deacon, who has been already quoted, "speaks its language so abominably as the English."

Stammering appears to be commoner among males than females.

Labour'd distinctions have been made between the two words, to stammer and to stutter, by which the infirmity is denoted. These seem to be wholly unnecessary, since they are practically synonymous. Both words contain an

imitation of the defect itself. They probably reach us through the German language, but the ultimate root is the Greek *Στεῖβω*, and the fundamental meaning movement abruptly checked. There is indeed a whole series of allied old English words such as lag, dag, jog, shog, stag, and cognates are stab, stagger, stamp. In some parts of the country a horse is said to stammer when he trips in walking. Bacon, in his "Natural and Experimental History," says: "Many stutters are very choleric, cholera inducing dryness of the tongue." It was long ago noticed by Sir Charles Bell in his *Bridgewater Treatise*, that speech, like writing, walking, and other functions of life, is a coordinate muscular act involving many nerves as well as muscles, but which, having been learned early, has become so automatic that the directing of special attention to it rather hinders than assists in its easy performance. Indeed the act not only involves the mechanism of speech proper, but also that of thought and ideation, as well as that of hearing, by means of which the sounds emitted are discriminated. It thus may never be developed, as in idiocy, of which the failure to acquire it is often the first sign; or in congenital deafness, which is the precursor of dumbness. It may also disappear entirely or partially in conditions of cerebral lesion known to medical men under the titles of aphasia, aphemia, and amnesia, often accompanying hemiplegia of the right side of the body. Real stammering may be produced by mental strain or shock, and persist through life. Such cases are rare, but the lecturer has been allowed to refer in general terms to one which can easily be verified—that of a clergyman who, after being overtaxed physically and mentally during one of the earlier cholera epidemics, began to stammer, and though now an old man, has never since been able to officiate in the service of the Church. Mr. Plumptre, in his lectures on Elocution, quotes even a more remarkable case from Dr. Mariano Semmola, where the loss of articulation was accompanied by convulsive movements, and instantly restored by bleeding.

The failure of coordination requisite to accomplish so complex a function may occur anywhere in the apparatus involved. Hence there are many forms of the affection, which may be roughly classified into four: (1) at the glottis, (2) at the isthmus of the fauces, (3) between the tongue and palate, (4) at the lips and posterior nares. The late Charles Kingsley, in his article quaintly named "The Irrationale of Speech," published in *Fraser's Magazine* for July, 1859, calls these four variations abuses of breath, jaw, tongue, and lips. But these by no means exhaust the catalogue of physical infirmities affecting speech, though being the most completely functional they fall strictly within the definition of stammering. Idiocy, deafness, and paralysis have been named, and to them may be added spasm, as in some cases of St. Vitus's dance. There are also several malformations and acquired disorders, such as (1) large or unsymmetrical tongue or tonsils, (2) cleft palate, (3) obstructed nasal passages, (4) high roofed mouth, (5) prominent and everted incisor teeth, which interfere with distinct articulation; besides the kindred bad habits called lisping, burring, and thickness of speech. Even then the list is not completed; for we have to add (1) a sort of hyperæsthesia or nervousness which occurs in some persons when they are out of health, and which disappears under better hygienic conditions; (2) tricks and bad habits, of which a flagrant example occurred some years ago, when a mania for transposition of words seized the younger and more thoughtless of the generation. A mutton chop, for instance, became a chutun mop, and one heard of the Chishop of Bicester, who had a sit of fickness through eating acon and beggs. In many cases the habit became uncontrollable, and is handed down to fame by the lady aunt of "Happy Thoughts," in *Punch*, who corrected errors of speech by reference to "Dixon's Johnsonary." (3) Mimicry, which produces a sort of contagiousness in

¹ Abstract by the Author of three Lectures at the Royal Institution, by W. H. Stone M.B., F.R.C.P. Concluded from p. 533.

mispronunciation. An instance of this occurred within the lecturer's experience at Marlborough School not long ago: one stammering member of a certain form having communicated his defect to several of his schoolfellows. (4) Bad teaching, and inattention to faults in their nascent condition. Many mothers think fit to accommodate their speech to favourite children by mutilating and defacing it; keeping two vocabularies, one for the drawing-room, another for the nursery. This is a fatal source of imperfections, the more so as it is to be remarked that stammering never comes on till about the age of five years or more.

Lastly come peculiarities of an unconscious character akin to stammering—clucking, coughing, the reiterated interpolation of otiose syllables such as “er er,” “ta ta”; even of definite words or sentences such as “you know,” or the coarse expletive adjectives of habitual swearers. The lecturer cited a case within his own remembrance where an estimable clergyman had acquired the singular trick of unconsciously interlarding all his remarks with the involuntary phrase, “What a pity! what a pity!” in defiance of all sense and context.

Methods of cure were then adverted to. Probably no human infirmity had been the object of such diverse or such blundering and unscientific treatment. Even so good a surgeon as Diefenbach cut wedges out of the tongue of the patient; Itard made them speak holding a gold fork in their mouth; Serres advised a waving motion of the arms during speech; Bertrand caused them to regulate the words to a rhythmical motion of the fingers, or to keep time to a stick as in the orchestra. He also placed substances in the mouth. This had been done centuries before by Demosthenes, according to that unvarnished gossip, Plutarch. These might be termed mechanical attempts at cure.

Next to them came musical methods, and foremost among them singing; it being well known that many confirmed stammerers sing with perfect articulation. Secondly, a so-called secret method, which consisted in either whispering or speaking in a gruff unmelodious tone. Thirdly, the very opposite of this as recommended by Marshall Hall, namely, chanting or monotoning. Fourthly, preceding all abrupt and consonantal sounds by a vowel such as E, recommended by Arnott. Fifthly, the plan of running all the words of a long sentence into one, and thus acquiring as it were an articulatory momentum.

Intellectual or rational methods brought the lecture to a close. First among these is pausing and deliberateness. The stammerer may be compared mechanically to a steamship which overruns her screw, and treated similarly. Secondly, the imitation of good models, by reading in unison with an articulate speaker. Thirdly, and perhaps best of all, prefacing every sentence by a deep breath, which relaxes all the muscles of speech, and enables them to start fairly one against another. Fourthly, a plan was suggested which had succeeded admirably in the lecturer's experience, namely, that of learning a new language. For this purpose none was better than French. Its pronunciation is so thoroughly different from that of English, that it requires and establishes a totally new coordination of muscles. Moreover its mode of habitual acquirement is entirely different from that of English. Any one who will watch a French child just rising out of infancy must notice that whereas the character of an English child's incipient speech is “smudging” and confusion, the other's is slow, pompous, and deliberate. It is not till later in life that the French acquire that lightning-like rapidity of speech which is the terror of foreigners; while young they speak well and slowly. The third lecture ended with a few directions how to proceed in a case of stammering, and some suggestions as to the prospects of cure. As to the former, it is obviously desirable to examine carefully for the exact seat and the exciting cause of the defect; most of the systems in

vogue having erred by exaggerating a particular treatment to the exclusion of others equally admissible. As to the latter, there is no doubt that stammering can be cured. This was proved by such instances as Demosthenes, Wilberforce, and Kingsley. But it was equally proved by the three names thus enumerated that to conquer the vicious habit required no usual amount of patience, ability, and determination.

DISTRIBUTION OF ENERGY IN THE SPECTRUM

IN the reaction against the arbitrariness of prismatic spectra there seems to be danger that the claim to ascendancy of the so-called diffraction spectrum may be overrated. On this system the rays are spaced so that equal intervals correspond to equal differences of wave-length, and the arrangement possesses indisputably the advantage that it is independent of the properties of any kind of matter. This advantage, however, would be lost, if in stead of the simple wave-length we substituted any function thereof; and the question presents itself whether there is any reason for preferring one form of the function to another.

On behalf of the simple wave-length, it may be said that this is the quantity with which measurements by a grating are immediately concerned, and that a spectrum drawn upon this plan represents the results of experiment in the simplest and most direct manner. But it does not follow that this arrangement is the most instructive.

Some years ago Mr. Stoney proposed that spectra should be drawn so that equal intervals correspond to equal differences in the *frequency of vibration*. On the supposition that the velocity of light in vacuum is the same for all rays, this is equivalent to taking as abscissa the *reciprocal* of the wave-length instead of the wave-length itself. A spectrum drawn upon this plan has as much (if not more) claim to the title of *normal*, as the usual diffraction spectrum.

The choice that we make in this matter has an important influence upon the curve which represents the distribution of energy in the spectrum. In all cases the intensity of the radiation belonging to a given range of the spectrum is represented by the area included between the ordinates which correspond to the limiting rays, but the form of the curve depends upon what function of the ray we elect to take as abscissa. Thus in the ordinary prismatic spectrum of the sun, the curve culminates in the ultra-red, but in the diffraction spectrum the maximum is in the yellow, or even in the green, according to the recent important observations of Prof. Langley. If we wish to change the function of the ray represented by the abscissa, we can of course deduce by calculation the transformed curve of energy without fresh experiments. To pass from the curve with abscissæ proportional to wave-length to one with abscissæ proportional to reciprocals of wave-length, we must magnify the ordinates of the former in the ratio of the square of the wave-length, and this will give us an energy curve more like that obtained with a prismatic spectrum.

There is another method of representation intermediate between these two, which is not without advantage. In the diffraction spectrum the space devoted to a lower octave (if we may borrow the language of acoustics) is greater than that devoted to a higher octave. In Mr. Stoney's map the opposite is the case. If we take the *logarithm* of the wave-length (or of the frequency) as abscissa, we shall obtain a map in which every octave occupies the same space, and this perhaps gives a fairer representation than either of the others. To deduce the curve of energy from that appropriate to the diffraction spectrum, we should have to magnify the ordinates in the ratio of the first power of the wave-length.

My object, however, is not so much to advocate any